Rehabilitation of Shoulder Injuries

- Functional Anatomy and Biomechanics
- Scapula Stability and Mobility
- AC Joint Sprain
- Clavicular Fractures
- GH Dislocation and Instabilities
- RC Tendonitis and Tears
- Chapter 17

Functional Anatomy and Biomechanics

- Mobility vs. Stability
- Coordinated function of 4 joints
  - Glenohumeral
  - Acromioclavicular
  - Sternoclavicular
  - Scapulothoracic
Sternoclavicular Joint (SC joint)

- Direct connection between upper extremity and trunk
- Clavicle and sternum union
  - Weak joint due to structural arrangement
  - Secured by strong ligamentous structure
- For scapula to abduct and upwardly rotate 180° clavicle must elevate 40°


Acromioclavicular Joint (AC joint)

- Weak joint with thin fibrous capsular support
- Ligaments
  - Acromioclavicular
  - Coracoclavicular
    - Trapezoid
    - Conoid
- Clavicular rotation allows for full shoulder elevation
  - Coracoacromial arch


Glenohumeral Joint (GH joint)

- Ball and socket joint involving articulation of humeral head with glenoid cavity of scapula
- Static restraints
  - Labrum
  - Joint capsule
  - Capsular ligaments (superior, middle, inferior)
- Dynamic restraints
  - Deltoid and rotator cuff muscles
Stability in Shoulder Joint

- Maintaining stability of shoulder complex while allowing a high degree of mobility critical for shoulder function
  - Instability often the cause of shoulder injuries
- GH joint is inherently unstable coordinated and synchronous actions of static and dynamic stabilizers provide joint stability

Transverse plane force couples
- Supraspinatus
- Infraspinatus / teres minor
- Co-contraction of infraspinatus / teres minor / subscap
  - Depress and compress humeral head during overhead mvt
Coronal plane force couple
- Deltoid and inferior rotator cuff muscles
  - Compressive force counteracts superiorly directed force of deltoid
  - Supraspinatus compress head of humerus into glenoid

Scapular Stability and Mobility
- Scapular muscles: produce scapular motion and dynamically position the glenoid for humeral motion
  - Scapular muscles include:
    1. Levator scapula and upper trapezius (elevate scapula)
    2. Middle trapezius and rhomboids (adduct scapula)
    3. Lower trapezius (adducts and depresses scapula)
    4. Pectoralis minor (depresses scapula)
    5. Serratus anterior (abducts and upward rotates scapula)
  - Collectively work to maintain consistent length-tension relationships within GH musculature

Scapulohumeral Rhythm
- Movement of scapula relative to the humerus
  - Initial 30° of glenohumeral abduction does not incorporate scapular motion (setting phase)
  - 30 to 90° the scapula abducts and upwardly rotates
  - Above 90° the scapula and humerus move in 1:1 ratio
  - If compromised or neglected during rehab full shoulder elevation is compromised, predisposing athlete to injury
**Plane of the Scapula**
- Resting position of scapula
  - 35-45° anterior to frontal plane (toward sagittal plane)
- Allows for true shoulder motion (less restricted)
  - Optimizes lengths of muscles associated with both the scapula and humerus (resulting in ↑ muscle force)

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**Acromioclavicular Joint Sprains**

*Pathomechanics*
- Mobile vs. Immobile
- Grading scale based on extent disruption to ligaments

*Injury Mechanism*
- Type I → II injuries occur due to fall on tip of shoulder with arm adducted or landing on outstretched arm
- Type III → IV usually involve a direct blow driving acromion down, back and inward and clavicle being pushed inferiorly
- Repetitive compression of joint

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**Type I**
- Relieve pain and sling for support
- Active assisted ex and isometrics can be performed
- After sling removal PRE should be added to encourage appropriate scapular motion
- Achieve good glenohumeral mechanics

**Type II**
- Immobilization is critical due to AC ligament disruption (7-14d)
- Heavy lifting and contact should be avoided for 8-12wk

**Type III**
- Operative vs. non-operative

**Type IV, V, VI**
- Operative vs. non-operative
- Open reduction and internal fixation resulting in immobilization and rehab time
**Rehabilitation Progression**

- Cold application and compression for 24-48hrs
  - Immobilization (dependent on severity)

- Begin isometric ex to maintain and restore muscle function
  - Introduce pendulum ex when removed from sling

- Strengthening should continue with PRE
  - Gradual push for NM control and sports specific activities

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- Early goals should focus on ROM restoration, preventing atrophy and pain reduction
  - Isometrics in cardinal planes (lateral rotation)

- NM control should be emphasized

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- Pain free; FROM
  - 70% strength compared to uninvolved side
  - High speed strengthening, plyometrics, PNF style training, isokinetics
**Clavicular Fractures**

**Pathomechanics**
- Clavicle serves as a strut connecting upper extremity to the trunk
- Forces acting on clavicle result in fracture of medial aspect

**Injury Mechanism**
- Direct or indirect
  - Fall on outstretched arm, fall or blow to the shoulder.

**Rehabilitation Progression**
- Immobilization for first 6-8 weeks
- Isometric exercises ↔ FROM ↔ PRE

**Criteria for Return to Play**
- Fracture exhibits clinical union
- Full FROM
- Strength and NM control required for participation in specific sports activity
Glenohumeral Dislocation & Instabilities (Surgical vs. Non-surgical)

Pathomechanics

- Shoulder dislocation involves temporary humeral head displacement from the glenoid
  - Joint mobility = susceptibility to injury
  - Anterior vs. Posterior
  - Rate of recurrence (85-90%)
- Results in capsular and ligamentous disruption, tendinous avulsion of rotator cuff, profuse bleeding, bicipital tendon displacement
  - Detached labrum, Bankart lesion, Hill-Sachs lesion
  - Brachial nerve and vessels may be compromised

Rehabilitation Concerns

- Restore axis of rotation
- Optimize muscle length-tension relationships, restore NM control
  - Work initially in plane of scapula below 55° of abduction

Rehabilitation Progression

- 12wks reasonable timeline for R2Act.
- 20wks for unrestricted activity
- ISO-ROM ⇔ TB/FROM ⇔ CKC/PRE ⇔ PLY
- Must modify strengthening exercises
  - Avoid potentially hazardous positions
  - Chance for re-injury and instability

- Limit inflammation, pain and retard muscle atrophy
- Initiate joint mobilization and passive ROM exercises
- Isometrics and scapula stabilizer exercises

- Active assisted ROM exercises
  - PNF techniques and manual therapy for NM control
  - CKC ex on stable and unstable surfaces

- Wk 6-12 goal restoration of str and NM control
  - Str should progress from PRE to plyometrics
  - Concentrate on eccentric rotator cuff ex
  - Multi-angle and sports specific activities

- Gradual return with interval training, emphasize end and stability
  - Shoulder str, pain and ability to protect involved shoulder critical
Pathomechanics
- Continuum starting with tendon impingement, compression, irritation, inflammation and fibrosis
- Injury in athletes generally result of repetitive tension or tissue compression (accumulation of microtrauma)

Injury Mechanisms
- Gradation of tendon failure
  - Primary compressive disease ⇔ Secondary compressive disease
  - Primary tensile overload ⇔ Secondary tensile disease
  - Macrotraumatic failure

Rehabilitation Concerns (Conservative Management)
Stage I
- Inflammation and pain reduction (modalities)
  - NSAIDs
- Begin ROM ex without further irritation
- Be mindful of arthrokinematics
- Gradual progression from isometrics to isotonic ex including work with scapular mechanics

Stage II
- Progress to reacquisition of full range of motion
  - May require aggressive stretching
- If continue pain free, strength training can be upgraded – include isokinetics
- Aggressive NM control regimen starting with manual therapy and progressing to tubing

Stage II (continued)
- Ex should then progress to free weights, focusing on eccentric
  - Deltoid and trapezius strengthening above 90°
  - Military press, push-ups+, reverse flys and shoulder flexion can be performed but may require modification
  - Plyometrics must also be incorporated

Stage III
- Focus on sports-specific activities
- Throwing athletes – interval overhead program must be initiated
- Total body conditioning, endurance and strength emphasis
- Athlete must remain pain free throughout rehab program
Rehabilitation Concerns (Post-Surgical Management)
- Very similar progression
- Rehabilitation begin with period of immobilization
  - Take into consideration surgical procedure
    - Subacromial decompression
    - Open repair of tendon
    - Capsular tightening
- Progression should follow that of conservative management plan
  (rule of six, wks 1-6; 6-12; 12-18)

Criteria for Return to Play
- Full ROM/normal mechanics restored in shoulder complex
- ≥ 90% strength involved vs. uninvolved side
- No pain during overhead activity

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**Therapeutic Exercises Progression**

1. Stretching Techniques
2. Scapular Stabilization
3. Dynamic Stabilization
4. Neuromuscular Control
5. Functional Training
6. Plyometrics